

ENHANCED CLEANING OF GENESIS SOLAR WIND SAMPLE 61348 FOR FILM RESIDUE REMOVAL. K. K. Allums, C. P. Gonzalez², K. R. Kuhlman³, J. H. Allton⁴ ¹HX5,LLC-Jacobs JETS Contract, NASA Johnson Space Center, Houston, TX 77058, ²Jacobs, NASA Johnson Space Center, Houston, TX, 77058, ³Plantary Science Institute, Tuscon, AZ 85719;kim@psi.edu, ⁴NASA Johnson Space Center, Houston, TX 77058

Introduction: The Genesis mission returned to Earth on September 8, 2004, experiencing a non-nominal reentry. During the recovery of the collector materials from the capsule, many of the collector fragments were placed on the adhesive portion of post-it notes to prevent the fragments from moving during transport back to Johnson Space Center. This unknowingly provided an additional contaminate that would prove difficult to remove with the limited chemistries allowed in the Genesis Curation Laboratory.

Generally when collector material samples are prepared for allocation to PIs, the samples are cleaned front side only with Ultra-Pure Water (UPW) via megasonic dispersion to the collector surface to remove crash debris and contamination[1]. While this cleaning method works well on samples that were not placed on post-its during recovery, it has caused movement of the residue on the back of the sample to be deposited on the front in at least two examples. Therefore, samples placed on the adhesive portion on post-it note, require enhanced cleaning methods since post-it residue has proved resistant to UPW cleaning.

Post-it Residue Contamination: Post-it residue was noticed on two flight samples after routine UPW wafer spinner cleaning. Observation of the backside of 12 different samples indicated a film-like material only on those samples transported on post-its (Fig. 1) after mission recovery. Figure 1 below shows sample 61332 with post-it residue on the backside.

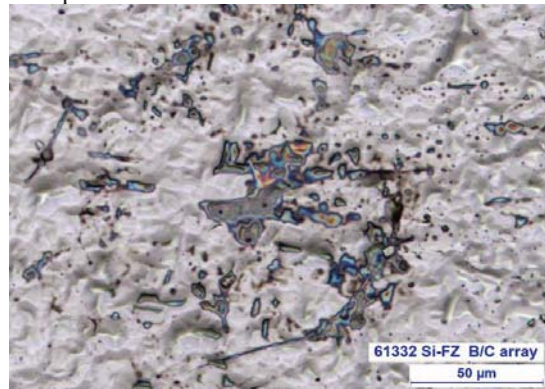


Figure 1: Post –it residue on Backside of 61332

The suspected post-it adhesive, once transferred to the front-side(solar wind side) by UPW proved to be difficult to remove with UPW, hot xylene, and aqua regia [2]. Figures 2 and 3 show a film-like residue was transferred from the back of sample 61332 to the front side.



Figure 2: Post-it Residue After UPW in Red Circles

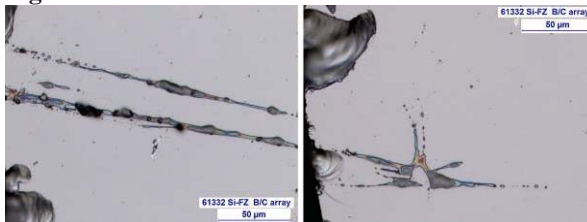


Figure 3: 50X image of the transferred Post-it residue.

For this reason we've had the composition of the post-it residue analyzed with SEM and EDX to identify the individual components of the post-it adhesive.

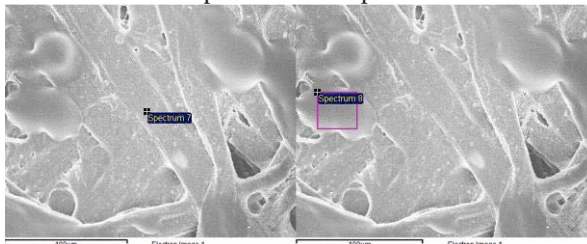


Figure 4: SEM images of EDX spectrum locations.

In the EDX spectra, the adhesive appears to have Al in it in addition to C and O (spectrum 8) and the “fibers” (spectrum 7) of the post-it also show a Si peak to be present. Based on the information presented, the best option would be to dissolve the post-it residue off the sample completely to prevent redeposition to the front of the sample during standard UPW cleaning with our wafer spinner system.

Experimental Methods: The Genesis Curation Laboratory has limited allowable wet chemistries. Due to this limitation it was decided to use reagent grade (99.98% pure) Isopropyl Alcohol (IPA) as an additional surface cleaner to remove the post-it note residue. Additional advantages for using IPA are it will not etch the surface or damage the solar wind in the flight samples thus preserving the science of the samples. A Genesis Flight Sample Pre-clean Method was developed to handle samples that have post-it residue on them. The Pre-Clean Method consists of a pyrex beaker filled with IPA in a sonicating bath for 5 minutes then rinsing the sample with clean IPA and transferring the sample

to another pyrex beaker filled with UPW then sonicating for 5 minutes. Once complete, the sample is rinsed with clean UPW and dried with clean Nitrogen.

A flight sample was selected from the Si flight inventory that was initially placed on a post-it note when recovered from the Utah Landing site. The sample was imaged and investigated for signs of post-it residue on the front and back of the sample. Two positions of interest were imaged at 50X with a Leica DM6000M microscope to track the cleaning process.(Fig.5 boxed in red) The following steps performed on Flight Sample 61348 were:

1. Imaged
2. 1st Pre Clean Method 1
3. Imaged
4. 2nd Pre Clean Method 1
5. Imaged
6. Standard UPW Wafer Spinner Clean
7. Imaged

The 2nd Pre Clean Method 1 was performed after noticing residue was still present on the front of the sample.

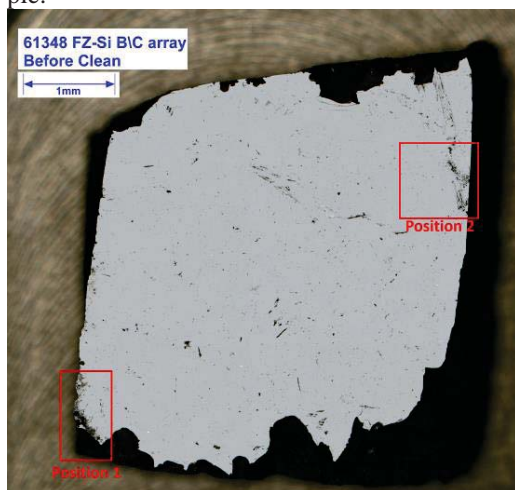


Figure 5: Flight sample 61348 before cleaning.



Figure 6: Before and After Cleaning of Position 1



Figure7: Shows Position 2 before and after cleaning.

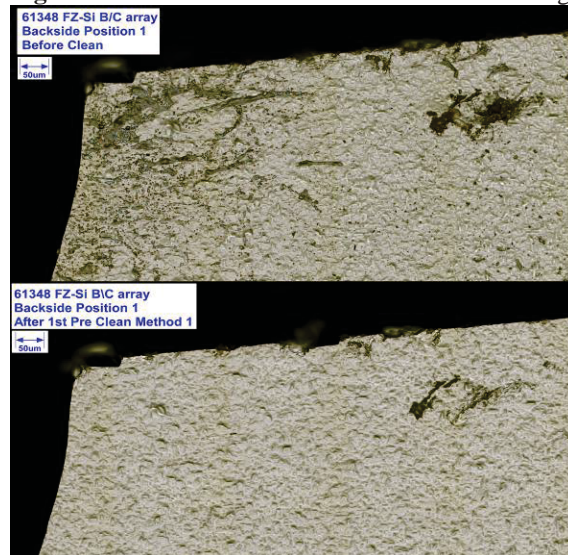


Figure 8: Backside of 61348 before and after Pre-Clean

Once all cleaning was completed the images show significant removal of the post-it residue as well as other particulate contamination. However, on the front of the sample in the positions of interest it seems some shadowing or hard to remove post-it residue remains. Observations of the backside of the sample show the added advantage of the submersive Pre-Cleaning Method removes particulate debris as well as post-it residue.

Conclusions: The Genesis Pre-Clean Method 1 removes significant post-it residue contamination as well as particulate debris from the Utah landing site on both the front and back of the sample and minimizes the probability of redepositing the adhesive or debris on the front of the sample. As shown in figure 8 the backside of the sample is virtually cleaned of all post-it note residue. Future work to use other solvents along with IPA and UPW to clean Genesis samples are in progress. However an approved clean laboratory without the chemistry restrictions of Genesis Curation Laboratory will have to be used.

References: [1] Calaway M. J. and Rodriguez M. C. (2009) *LPSC, XL*, Abstract #1183.[2] Goreva Y. S. (2015) *LPSC XLVI*, Pending Acceptance.